DOCUMENT RESUME

ED 349 116 PS 020 802

AUTHOR Hertel, Cary; And Others
TITLE Touch Window versus Power Pad: A Comparison of Response Rates by 3- and 4-Year-Old Handicapped and Nonhandicapped Children.
PUB DATE 89
NOTE 9p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Disabilities; *Input Output Devices; *Performance Factors; *Young Children
IDENTIFIERS Response Patterns; *Touch Terminals

ABSTRACT

This study investigated the effect of input devices on the use of a computer program by 3- and 4-year-old handicapped (n=9) and nonhandicapped (n=9) children in a small community in northwestern Kansas. Children used a software program that taught them how to understand colors and shapes. This program was used to collect data on the user's number of correct, incorrect, and total responses. Children were divided into two groups, one of which used a screen touch window to access the computer, and one of which used a power pad, or touch-sensitive tablet, to access the computer. After 4 weeks, children switched to the use of the opposite input device for another 4 weeks. Results indicated that handicapped children produced fewer responses than nonhandicapped children when they used the touch window, and more responses when they used the power pad. All but three children produced more responses when using the power pad than when using the touch window. Compared to nonhandicapped children, handicapped children exhibited a higher percentage of accurate responses when using the touch window, and a lower percentage when using the power pad. All children exhibited a higher percentage of accurate responses when using the touch window than when using the power pad. Thirteen references are cited. (BC)

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Touch Window versus Power Pad: A comparison of response rates by 3 and 4 year old handicapped and nonhandicapped children

Cary Hertel, Rainbows United, Wichita, KS
Michael L. Kallam, Fort Hays State University, Hays, KS
Michael Rettig, Fort Hays State University, Hays, KS

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ED349116

Abstract

This study investigated the effects of the Edmark Touch Window and the Dunamis Power Pad on the frequency and accuracy of responding using *Early Learning* (Version 3.5) (Marblesoft, 1987). The subjects were 18 students, 9 handicapped and 9 nonhandicapped, ranging in age from 3-0 to 4-11, who attended an early childhood education center in a small community in northwest Kansas. Participants were pretested using the *Brigance Diagnostic Inventory of Early Development*.

The students then began the randomly assigned intervention of using either the Touch Window or the Power Pad as a response mode to computer generated instructional tasks. Subjects were posttested with the same instrument and then switched to the alternate and previously unused response mode. Students were tested a third time using the same instrument.

The results of this investigation revealed that the different computer input devices significantly influenced the frequency and accuracy of responses. The Touch Window produced the lowest frequency of response, but the highest accuracy of responses.

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Computer use with young children is facilitated when alternative computer input devices are used (Dyril, 1985). This is due to the difficulties that commonly arise when young children encounter the standard typewriter-style keyboard. Problems commmonly encountered include difficulty and frustration in trying to press the proper key, an inability to read letters and numbers on the keyboard, and the distraction that may be caused by the keyboard (Rettig, 1986a).

Many young children are not ready for the standard typewriter-style keyboard and this has often posed a barrier to learning (Center for Special Education Technology, 1989; Dyril, 1985). Alternative input devices may be used to enable handicapped students to use the computer to communicate and manipulate their environments, providing a means of interaction with others and the environment in a unique way (Elting and Bailey, 1987).

One extremely important consideration when using computer systems with young handicapped children is determining the most effective and efficient means of response input. The Center for Special Education Technology (1989) suggests that a computer system for young children should allow the use of alternative input devices. Alternative input devices can have an influence on a child's ability to respond correctly (Rettig, 1986a). By providing an appropriate means of responding very young disabled children may use the computer effectively. Young handicapped children may even use software programs independently when they are able to respond in a way that does not require them to think about how to respond or provide input (Rettig, 1986b).

Children may benefit by using adaptive computer input devices. Rettig (1986b) suggests that adaptations made in the response mode may enhance a child's ability to use the computer effectively. Buckleiter and Hohmann (1987) state that a search for good software and input devices that decrease keyboard dependence is an ongoing priority.

The purpose of input devices is to send information to the computer so it can be processed and displayed in a manner which is meaningful to the user. This can help a young learner to make sense out of the information he/she is entering into the computer and supplement the learning activity. Input devices can provide for cognitive enhancement, as well as increase physical accessibility to the computer. However, the goal of alternative input devices for young children is to provide the children with an input device which allows them to enter information easily and provide visual and/or auditory information to compliment the learning environment (Morris, 1988b). Six broad categories of computer input are available. These methods include: keyboards, expanded keyboards, hand-held devices, single switches, touch screens, and speech input (Rettig, 1986a).

By incorporating adaptive devices with the computer exceptional children may benefit even more. This modification to the standard hardware is necessary in order to enable the individual to

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communicate and/or manipulate his/her environment. Adaptive devices such as joysticks, touch pads, and a variety of switches enable children with physical disabilities to access the computer. These devices help the physically disabled child to communicate and/or manipulate objects in their environment.

Children with communication disorders can use augmentative communication systems attached to the computer to communicate through pictures, symbols, or synthesized speech. This allows the nonverbal child to communicate with others. Adapting the mode of input can also allow children with learning disabilities to interact with the computer independently (Elting and Bailey, 1987). Input can be a concern because of the cognitive and/or motor skills required to use the input device and the cost of the input devices (Rettig, 1987).

Previous Research

Three studies involving the use of alternative computer input devices all concluded that alternative input devices can be a beneficial way of accessing the computer for many students (Battenberg and Merbler, 1989; Elf, 1987; Rettig, 1984). Two studies found that the keyboard method of computer input produces more errors and less accuracy for both handicapped and nonhandicapped students when compared to other input devices (Battenberg and Merbler, 1989; Rettig, 1984). Touch screens were found to be easier to use and improved the task performance of both handicapped and nonhandicapped students (Battenberg and Merbler, 1989). Touch screens also provided a motivational means of accessing the computer for children of various ages, abilities and disabilities (Elf, 1987).

Although studies (Battenberg and Merbler, 1989; Rettig, 1984) were found which compared the keyboard method of computer input with other input devices, neither study involved the use of expanded keyboards. However, both studies did reveal that the keyboard is an inefficient method of computer input with young children. Concluding that alternative computer input devices are more effective, a question rises of how expanded keyboards compare to touch screens in their effectiveness with young children.

METHODOLOGY

Subjects

Eighteen children ranging in age from 3-0 to 4-11 years of age participated in this study. Subjects for the study came from an early childhood education center in a small community in northwestern Kansas. Subjects included 9 handicapped children, who were receiving special education services for developmental delays, mental handicaps, and/or physical handicaps. The remaining 9 subjects were nonhandicapped children enrolled at the center, who were not receiving any special education services.

Subjects were selected through a process of random stratified selection with equal numbers of subjects in each of the two predetermined categories: 3 and 4 year old handicapped children, and 3 and 4 year old nonhandicapped children. Subjects were also involved in various and ongoing CompuPlay activities, computer assisted instructional situations. Table 1 indicates the characteristics of each subject.

Instruments

The assessment instrument which was used as a pretest and posttest with all subjects was the *Brigance Diagnostic Inventory of Early Development* (Brigance, 1978). The knowledge and comprehension sections of this test were used to pretest the subjects prior to the intervention on the computer and input device. It was then used to posttest the subjects following their individual interventions with each input device. The rationale for using this test was that it tested the specific skills which *Early Learning* (Version 3.5, Marblesoft, 1987), the instructional software, emphasized, i.e., colors, shapes, etc. A developmental age was determined for knowledge of both colors and shapes using this test.

Table 1. Subject Characteristics.

Subject	Age	Handicap	Compuplay	Home Computer
1	3	DD - physical	yes	no
2	3	MR	yes	no
3	3	DD - physical	no	no
4	3	DD	yes	no
5	4	DD	no	no
6	4	MR - physical	no	no
7	3	DD	no	no
8	3	MR	yes	no
9	4	DD	no	no
10	4		no	no
11	4		yes	no
12	4		no	no
13	4		no	no
14	3		no	no
15	4		no	no
16	3		yes	no
17	3		no	no
18	4		no	no

DD = developmentally delayed MR = mental retardation
physical = physically limited

Special Equipment

Special equipment used in this study included an Apple IIGS microcomputer configured with a 5¼" and a 3½" disk drive, a 13" color monitor, and an Echo II speech synthesizer. The monitor was positioned directly on top of the computer with the speech synthesizer placed on top of the computer. The computer equipment was set up in a small room with a table on which an Apple IIGS computer was placed.

An Edmark Touch Window was used for the touch screen input device. This is a transparent, flat, pressure-sensitive surface affixed to the monitor's screen. The Touch Window allowed the student to respond by simply touching the appropriate section on the screen.

A Dunamis Power Pad was used for the expanded keyboard input device. The Power Pad is a touch-sensitive tablet that can serve as both an alternative keyboard and a graphic tablet. The Power Pad plugs into the internal game port of the Apple computer. The Power Pad was placed on the child's lap with the top edge resting on the table. This allowed the Power Pad to be angled at 10-15° without blocking the subject's view of the monitor. The child responded by pressing an area on the pad which was covered with an overlay appropriate to the computer generated intervention.

The computer software used in this study was *Early Learning* (Version 3.5, Marblesoft, 1987). This program enables children to access the computer through a variety of input devices including the Touch Window and the Power Pad. This software program was selected for it's clear and simple graphics, large letters, positive speech reinforcement, and various levels of difficulty. This program also collects data on the student's correct and incorrect responses, total number of responses, and computes a percentage of correct responses.

Experimental Design and Treatment Procedures

A pretest-posttest counterbalanced techniques design was used to determine the effectiveness of the treatments. Each subject was pretested by administering the knowledge and comprehension sections of the *Brigance Diagnostic Inventory of Early Development (Brigance)* (Brigance, 1978) which involved colors and shapes.

The subjects were then individually exposed to one of the two input devices. The entry level of instruction on either colors or shapes was dependent on the subject's *Brigance* pretest scores. Each subject was started at the independent level of instruction to minimize frustration with content. This first intervention period lasted for 4 consecutive weeks. Subjects were retested using the *Brigance* and then switched to the alternate input device. At the conclusion of this 4 week period, the subjects were tested again with the *Brigance*. Due to the limited attention span found at this age, the interventions were kept to 2 sessions per week for 3 minutes per session during the course of the study. The level of instruction intensity remained constant throughout both interventions in order to maintain consistency.

Data Analysis

Data on the number of correct and incorrect responses, total number of attempted responses, percentage of correct responses, number of requests for assistance, and anecdotal comments were recorded for each subject during each session utilizing both input devices. The statistical analysis of the data was undertaken using descriptive statistics and multiple analysis of variance with between group comparisons.

Results

Frequency of responses were calculated for each subject during each session at the computer. The mean of frequency of response and the standard deviation of frequency of response was calculated for each child on the Touch Window and on the Power Pad. A comparison was made of the mean and standard deviation for frequency of responses on the Touch Window and on the Power Pad according to age and handicapping status (see Table 2).

Table 2. Mean and Standard Deviation for Frequency Percentage of Responses Per Minute.

		Touch Window		Power Pad	
Subjects	n	$\bar{X}$	SD	$\bar{X}$	SD
3 year olds	9				
Handicapped	6	4.17	.58	9.11	3.38
Nonhand.	3	4.58	.29	5.33	1.84
4 year olds	9				
Handicapped	3	4.07	.75	7.09	2.54
Nonhand.	6	4.28	.47	4.86	1.20

Table 2 indicates that the average frequency of responses for the handicapped subjects regardless of age was lower than for the nonhandicapped subjects when using the Touch Window. There was

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also a greater standard deviation for the frequency of responses for the handicapped subjects than for the nonhandicapped subjects regardless of age when using the Touch Window. This suggests that the handicapped subjects responded more frequently and with less consistency in frequency of responses between sessions than the nonhandicapped subjects when using the Touch Window.

The average frequency of responses for handicapped subjects was higher than for disabled subjects when using the Power Pad. The standard deviation was also greater for the handicapped subjects than for the nonhandicapped subjects when using the Power Pad. This suggests that disabled subjects responded more frequently and with less consistency in frequency of responses between sessions than the nonhandicapped subjects when using the Power Pad.

When making a comparison between the Touch Window and the Power Pad it is evident that the Power Pad produced a higher frequency of responses and a larger standard deviation in frequency of responses. This suggests that when using the Power Pad the subjects responded more frequently and with less consistency than with the Touch Window.

A look at the subjects' individual mean frequency of responses and standard deviation frequency of responses (see Table 3) indicates that for all but 3 subjects the mean frequency of response was higher when using the Power Pad than when using the Touch Window. This demonstrates that the Power Pad produced a higher mean frequency of responses with most of the subjects. For those whom it did not, there was not a large amount of difference between their mean frequency of responses with the Power Pad and their mean frequency of responses with the Touch Window.

Table 3. Individual Mean Frequency of Responses and Standard Deviation Frequency of Responses.

			Touch Window		Power Pad	
Subject	Age	Hand.	$\bar{X}$	SD	$\bar{X}$	SD
1	3	yes	4.72	.36	13.00	4.19
2	3	yes	3.77	.75	4.23	5.11
3	3	yes	4.46	.50	5.67	1.99
4	3	yes	4.40	.44	5.72	1.78
5	4	yes	4.29	.49	4.28	.88
6	4	yes	3.43	1.31	9.48	2.31
7	3	yes	4.11	1.00	7.23	3.59
8	3	yes	3.57	.46	8.83	3.59
9	4	yes	4.50	.46	7.50	4.44
10	4	no	4.22	.17	4.17	.25
11	4	no	4.67	.19	6.11	1.59
12	4	no	4.46	.35	4.73	1.48
13	4	no	3.80	.50	4.08	.56
14	3	no	4.71	.28	4.87	.39
15	4	no	4.21	.85	4.67	1.17
16	3	no	4.76	.32	4.56	.54
17	3	no	4.27	.28	6.57	4.59
18	4	no	4.29	.73	5.33	2.16

The standard deviation for the frequency of responses using the Touch Window and Power Pad revealed that there was greater variance in the frequency of responses with every subject when using the Power Pad when compared to the Touch Window. This suggests that the Touch Window produced more consistent frequencies of response than the Power Pad for all the subjects participating in the study.

Multiple analysis of variance was used to compare the subjects' mean frequency of responses on the Touch Window with their mean frequency of responses on the Power Pad. These comparisons were calculated by age, for 3 year olds and 4 year olds; by disability status, for handicapped subjects as a group, nonhandicapped subjects, and handicapped subjects according to specific category of handicapping condition; and by level of technology awareness that might be expected between Compu-Play subjects and non-CompuPlay subjects.

Significant statistical differences were found to exist in the response rates of 3 year olds, 4 year olds, handicapped subjects, nonhandicapped subjects, and non-Compuplay subjects (see Table 4). This suggests that there was a significant difference in the mean frequency of responses on the Touch Window and the mean frequency of responses on the Power Pad for subjects in those specific groups. No statistically significant difference was found to exist in response rates for specific categories of handicapping conditions or for CompuPlay subjects.

A between groups comparison was calculated for the mean frequency of responses on the Touch Window when compared to the mean frequency of responses on the Power Pad (see Table 5). This test

Table 4. Results from Multiple Analysis of Variance Samples for Touch Window Mean Frequency of Responses Compared to Power Pad Mean Frequency of Responses by Groups.

Subject groupings	dF	f-Value	
3 year olds	8	17.16	*
4 year olds	8	16.33	*
Handicapped	8	21.84	**
Nonhandicapped	8	17.11	*
Non-Compuplay	11	24.43	*

*$p < .05$ **$p < .01$

compared all 18 subjects' mean frequency of responses on the Touch Window with their mean frequency of responses on the Power Pad. The test revealed a statistically significant difference at the .01 level between the mean frequency of responses with the Touch Window and the mean frequency of responses with the Power Pad. This suggests that as a whole the subjects produced significantly different frequency of responses with the 2 different input devices. After comparing each subjects' mean frequency of responses on the Touch Window with their mean frequency of responses on the Power Pad, it becomes evident that the Power Pad produced the higher mean frequency of responses of the two input devices.

Table 5. Between groups Comparison of the Mean Frequency of Responses on the Touch Window and the Mean Frequency of Responses on the Power Pad.

Statistic	Value
No. of Pairs of Scores	18
f-Value	33.44 *
Degrees of Freedom	17

*p < .01

Anecdotal comments recorded during the interventions on the computer indicated that all 18 subjects, in at least one session, produced higher frequency of responses due to pressure applied to the bottom or side of the Power Pad. This was due to the software program recording responses continually as pressure was applied, both accidentally and due to a desire to see the computer *"react,"* to an area on the Power Pad where a color or shape was not located. This in turn contributed to higher frequency of responses on the Power Pad than the Touch Window.

The accuracy of responses was obtained for each subject during each session at the computer. The mean accuracy and standard deviation accuracy of responses were calculated for each child on each input device. A comparison was made of the mean and standard deviation for accuracy of responses on the Touch Window and on the Power Pad according to both the subject's age and handicapping condition (see Table 6).

Table 6 indicates that handicapped subjects, regardless of age, had higher accuracy of responses than the nonhandicapped subjects when using the Touch Window. The 3 year old handicapped subjects had a greater standard deviation accuracy of responses than the nonhandicapped 3 year olds.

Table 6. Mean and Standard Deviation for Accuracy Percentage of Responses.

		Touch Window		Power Pad	
Subjects	n	$\bar{X}$	SD	$\bar{X}$	SD
3 year olds	9				
Handicapped	6	91.30%	10.25	32.39%	14.82
Nonhand.	3	91.11%	5.94	80.00%	14.25
4 year olds	9				
Handicapped	3	91.87%	9.03	63.15%	26.11
Nonhand.	6	86.59%	10.05	72.20%	17.16

However, the handicapped 4 year olds had a lower standard deviation accuracy of responses than the nonhandicapped 4 year olds when using the Touch Window. These results suggest that the handicapped subjects produced higher accuracy of responses than the nonhandicapped subjects when using the Touch Window.

On the Power Pad, the handicapped subjects regardless of age had a lower mean accuracy of responses than the nonhandicapped subjects. The handicapped subjects, regardless of age, also had a greater standard deviation accuracy of responses on the Power Pad. These results indicate that the handicapped subjects produced lower accuracy of responses and less consistency in accuracy of responses between sessions when using the Power Pad.

A comparison between the Touch Window and the Power Pad reveals that the Touch Window produced higher mean accuracy of responses and a lower standard deviation accuracy of responses than the Power Pad. This suggests that when using the Touch Window the subjects responded with better accuracy and with greater consistency in accuracy between sessions than with the Power Pad.

Comparison of the subjects' individual mean and standard deviation accuracy of responses (see Table 7) indicates that the mean accuracy of responses was higher for every subject when using the Touch Window than when using the Power Pad. The standard deviation for the accuracy of responses was greater for all except 4 subjects when using the Power Pad. This indicates that most subjects accuracy of responses were more consistent with the Touch Window than with the Power Pad.

Multiple analysis of variance comparing Power Pad mean accuracy of responses with Touch Window mean accuracy of responses was conducted for 3 year olds, 4 year olds, handicapped subjects, nonhandicapped subjects, subjects according to specific category of handicapping condition,

Table 7. Individual Mean Accuracy of Responses and Standard Deviation Accuracy of Responses.

			Touch Window		Power Pad	
Subject	Age	Hand.	$\bar{X}$	SD	$\bar{X}$	SD
1	3	yes	97.57%	6.43	16.67%	10.29
2	3	yes	88.14%	9.72	2.33%	3.67
3	3	yes	98.88%	3.18	61.17%	25.66
4	3	yes	82.40%	20.56	69.17%	14.18
5	4	yes	91.43%	6.58	83.00%	11.19
6	4	yes	99.00%	2.65	47.29%	25.53
7	3	yes	84.83%	16.59	38.33%	25.99
8	3	yes	96.00%	5.03	12.60%	9.15
9	4	yes	85.17%	17.87	59.17%	41.60
10	4	no	97.17%	4.40	92.88%	6.56
11	4	no	100.00%	.00	53.00%	18.36
12	4	no	86.63%	5.15	82.00%	20.69
13	4	no	77.20%	11.56	73.00%	9.21
14	3	no	100.00%	.00	95.75%	6.86
15	4	no	77.38%	19.54	74.86%	16.72
16	3	no	97.14%	7.56	91.83%	9.13
17	3	no	76.20%	10.26	52.43%	26.77
18	4	no	81.14%	19.62	57.43%	31.39

Compuplay subjects, and non-Compuplay subjects. The comparisons revealed significant differences for 3 year olds, 4 year olds, handicapped subjects, nonhandicapped subjects, mentally retarded subjects, Compuplay subjects, and non-Compuplay subjects (see Table 8). These results indicate that there was a significant difference in the mean accuracy of responses on the Power Pad and the mean accuracy of responses on the Touch Window for those groups. No significant difference was found for any specific category of handicapping conditions except mental retardation.

Table 8. Results from Multiple Analysis of Variance for Power Pad Mean Accuracy of Responses Compared to Touch Window Mean Accuracy of Responses by Groups.

Subject grouping	dF	f-Value	
3 year olds	8	20.76	**
4 year olds	8	16.00	*
Handicapped	8	24.84	**
Nonhandicapped	8	29.47	***
Mentally Retarded	1	6.99	**
Compuplay	5	13.53	*
non-Compuplay	11	27.85	**

*p < .05 **p < .01 ***p < .001

A between groups comparison was also calculated for the mean accuracy of responses on the Power Pad when compared to the mean accuracy of responses on the Touch Window (see Table 9). This test compared all 18 subjects' mean accuracy of responses on the Power Pad with their mean accuracy of responses on the Touch Window. This test revealed a statistically significant difference at the .001 level between the mean accuracy of responses using the Power Pad when compared to the mean accuracy of responses using the Touch Window. This indicates that as a whole the subjects produced significantly different mean accuracy of responses with the two different input devices. After comparing each subjects' mean accuracy of responses on the Power Pad to their mean accuracy of responses on the Touch Window, it becomes apparent that the Touch Window produced the higher mean accuracy of responses of the two input devices.

Table 9. Between Groups Comparison of Responses on Power Pad when Compared to Touch Window.

Statistic	Value
No. of Pairs of Scores	18
f-Value	44.47 *
Degrees of Freedom	17

*p < .001

Anecdotal comments recorded by the researcher during the interventions on the computer indicated that all 18 subjects produced lower accuracy of responses on at least one session, due to the subjects pressing the bottom or the side of the Power Pad. Pressing the bottom or sides of the Power Pad when using this software program resulted in incorrect responses being recorded by the computer. Anecdotal comments also indicated that five subjects made intentionally incorrect responses on the Power Pad. Four of these five subjects also made intentionally incorrect responses on the Touch Window. These two intentional behaviors influenced the Power Pad producing a lower accuracy of responses.

Discussion

Significant differences in the frequency of responses by subjects using the 2 different input devices were found. The highest frequency of responses was found when using the Power Pad and the lowest frequency of responses when using the Touch Window. This was also found to be true with the following groups: 3 year olds, 4 year olds, handicapped, nonhandi-capped, and non-CompuPlay. Examination of the frequency of responses for each subject indicated the same results for all except three subjects.

The distinguishing feature between the 2 different input devices when using *Early Learning* (Version 3.5, Marblesoft, 1987) was that with the Power Pad pressure to any portion of the active area resulted in recorded responses. The Touch Window only recorded responses made in which the child pressed an area on the screen which had either a color or shape on it. The Power Pad recorded responses if the child had their hand pressing on the active area where a color or shape was not located. Therefore, an apparent advantage of using the Touch Window is that only the areas on the Touch Window in which a color or shape was located was actually active during the computer program. Another apparent advantage of the Touch Window is that accidental pressure applied to the Touch Window when holding onto the edges of the Touch Window does not result in recorded responses.

Results indicated a significant difference in the accuracy of responses by children using the two different input devices. The highest accuracy of responses was found when using the Touch Window and the lowest accuracy of responses when using the Power Pad. The same results were found when comparing the accuracy of responses with the following groups: 3 year olds, 4 year olds, handicapped, nonhandicapped, mentally retarded, Compuplay and non-Compuplay. When looking at the accuracy of responses by individuals, the same results were obtained for every individual.

The way in which the Power Pad recorded responses when using *Early Learning* (Version 3.5, Marblesoft, 1987) played a major role in the subjects accuracy of responses. Accidental placement of one hand on the bottom or edge or one side of the Power Pad set the computer off recording incorrect responses. However this was not true when using the Touch Window. This placed the subjects at a advantage when using the Touch Window since the only incorrect responses recorded by the computer when using the Touch Window were those made by pressing an incorrect color or shape on the screen.

Another contributing factor for the Power Pad producing lower accuracy of responses overall, is due to five of the subjects making intentionally incorrect responses when using the Power Pad. The total number of sessions in which intentionally incorrect responses were made is 20 out of a total of 116 sessions on the Power Pad. Intentionally incorrect responses were made by 5 subjects on the Touch Window. The total number of sessions in which intentionally incorrect responses were made is 7 out of a total of 121 sessions on the Touch Window. This indicates that there were more sessions on the Power Pad in which subjects made intentionally incorrect responses than on the Touch Window. Observation of subjects demonstrated that a reason for more sessions with intentionally incorrect responses on the Power Pad was due to the computer responding "no" when pressure was applied to the bottom of the Power Pad. For these subjects, a smile or laugh when the computer said "no" continuously while pressure was being applied to the bottom of the Power Pad was observed.

Clearly more research is needed in this area. Different input devices can and do influence a child's frequency and accuracy of responding to computer generated stimuli. The general findings of this study are consistent with those of Rettig (1984). Researchers must work to identify both how and why certain input devices work better with children so that error likely operations may be minimized.

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